IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Fred Berkowitz et al.	Art Unit	: 1745
Serial No.	: 10/719,056	Examiner	: Monique Wills
Filed	: November 24, 2003	Conf. No.	: 9130
Title	: BATTERY INCLUDING ALUMINUM COMPONENTS		

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY TO ACTION OF OCTOBER 10, 2007

In reply to the Office Action of October 10, 2007, Applicants submit the following remarks. Claims 1-27 and 29-36 are presented for examination. Claims 37-53 were withdrawn.

The Examiner maintained the 35 U.S.C. § 102(e) and 35 U.S.C. § 103(a) rejections based primarily on Nakanishi et al., U.S. Pat. 6,521,374 ("Nakanishi"). However, applicants and the Examiner are in agreement that the claims are substantially different from Nakanishi. See Response to Arguments on pages 13-14 of the office action mailed October 10, 2007.

The main remaining issue appears to be the last clause of claims 1 and 30, which reads:

> wherein the battery has an impedance that increases by less than 0.20 ohms after the battery is dropped six times from a height of one meter onto a hard surface.

This clause was added in the previous amendment to emphasize an advantage (a property) achieved in the claimed battery. In particular, applicants discovered that including an aluminum-aluminum contact between a cathode current collector and a positive lead provides a more robust connection than an aluminum-stainless steel contact. Such an aluminum-aluminum contact can result in a battery having an impedance that increases by less than 0.20 Ohms after the battery is dropped six times from a height of one meter onto a hard surface.

The Examiner rejected claims 1-27 and 29-36 under 35 U.S.C. § 112, ¶ 1 for lack of enablement. According to the Examiner:

> The method of reducing the impedance is critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). ***.It is unclear as to whether the battery having an impedance increased [t]o less than 0.20 Ohms after the batter[y] is dropped si[x] times is a method limitation and it is unclear as to

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how such a limitation defines the battery structure. An appropriate correction is required.

The last clause of claims 1 and 30 recites a property. It merely requires the battery covered by the claims to have an impedance that increases by less than 0.20 ohms after the battery is dropped six times from a height of one meter onto a hard surface. How this test is performed is discussed in more detail in Example 4 on pages 12 and 13 of the application:

> In the drop test a cell was dropped six times (two times each in top, bottom, and side orientation) from a height of one meter onto a rigid concrete surface. The impedance was measured at ambient conditions using an impedance meter set to a frequency of 1000 Hz and capable of measuring voltage to an accuracy of ± 1%. The measured changes in impedance for the different types of cells after a drop test are shown in FIG. 4.

The drop test is based on a known test, IEC 60068-2-32. See paragraph 6.3.2.8 of the attached.

The results of the test "draft" are shown in Table 4 (on page 13):

Table 4

Cell #	Grid material	Positive lead material	Impedance, fresh (Ohms)	Impedance change after drop (Ohms)	CCV, fresh (V)	CCV change after drop (V)
1	Al 6061	SS 316	0.144	0.28	2.45	-0.25
2	Al 6061 DB	SS 316	0.206	15.9	2.29	-0.90
3	Al 6061 DB	Al (no ext)	0.130	3.57	2.54	-0.92
4	Al 6061 DB	Al (ext)	0.127	0.06	2.56	-0.14
5	Al 6061 DDB	SS 316	0.201	10.7	2.25	-0.92
Control	SS 316	SS 316	0.150	0.14	2.42	-0.23

Cells 3 and 4 include an aluminum current collector (the "grid material") crown and positive lead. The positive lead in cell 4 also includes an extension (see "ext" in Table 4) directed towards the cathode. Example 4 had an impedance change of less than 0.2 Ohms (specifically, only 0.06 Ohms) after being subjected to the drop test.

Applicants submit that the "drop test" property required by the claims is clear. It is not a method limitation, but rather a property. The test to determine the property is straightforward and a person of ordinary skill in the art would understand how to conduct the test to determine if a battery possesses the property. Thus, applicants respectfully request that the 35 U.S.C. § 112, ¶ 1 rejection be withdrawn.

Applicants further note that the drop test property is not needed to distinguish the batteries covered by the claims from the battery described by Nakanishi. The battery described by Nakanishi has a much different design; applicants will discuss this again in detail below. Thus, to the extent the Examiner still believes the claim language describing the drop test property is confusing, applicants would be willing to delete the property from the claims to expedite allowance.

Applicants will now discuss why the claims are patentable over Nakanishi.

Claims 1-3, 5-13, 18-23, and 25-29 were rejected under 35 U.S.C. § 102(e) over Nakanishi; applicants note that claim 28 was cancelled previously. Claim 4 was rejected under 35 U.S.C. § 103(a) over Nakanishi. Claims 14-17 and 30-36 were rejected under 35 U.S.C. § 103(a) over Nakanishi in combination with Tischer et al., Corrosion Science, Vol. 26, No. 5, pp. 371-375 (1986) ("Tischer"). Finally, claim 24 was rejected under 35 U.S.C. § 103(a) over Nakanishi in combination with Shembel et al., U.S. Publication No. 2003/0031933 ("Shembel"). Applicants respectfully request that these rejections be withdrawn.

Claims 1-27 and 29-36 cover primary lithium batteries including a cylindrical housing including a first end and a second end and having a continuous external wall defining an opening at the first end and enclosing the second end; a cathode within the housing including a current collector, the current collector having an exposed end shaped into a crown including aluminum; a positive lead including aluminum within the housing in contact with the crown; and a positive external contact in contact with the positive lead, closing the opening defined by the external wall at the end of the housing; the battery has an impedance that increases by less than 0.20 Ohms after the battery is dropped six times from a height of one meter onto a hard surface. Nakanishi does not disclose or suggest such batteries. Instead, Nakanishi discloses a secondary battery having a construction as illustrated in FIG. 2, shown below:

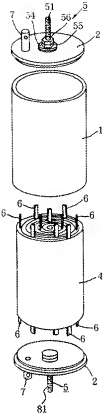

FIG. 2. (See, e.g., Nakanishi, FIG. 2).

Importantly, Nakanishi's secondary battery has openings at both ends, defined by a cylindrical wall of housing 1, to which lids 2, 2 are welded onto. Terminal assemblies 5, 5 seal the holes in lids 2, 2 of the battery. Positive terminal 5 has an electrode terminal 51, which includes a screw member extending through a hole in lid 2, a first nut 55 and a second nut 56 which screw onto the screw member. Nut 55 is tightened to clamp the terminal 51 to seal off the hole. (See, e.g., Nakanishi, FIGS. 1 and 2; col. 4, lines 50-61; and col. 5, line 8-21.) Similarly, negative terminal 5 has a negative electrode terminal 81, which is assembled in an analogous manner to terminal 51. (See, e.g., id, col. 5, lines 28-32). Therefore, Nakanishi does not disclose or suggest a housing having a continuous external wall defining an opening at the first end and enclosing the second end, as required by the claims. The openings defined by the housing wall of Nakanishi's battery are not closed by a positive external contact in contact with a positive lead. Instead, Nakanishi's openings at the top and bottom of his battery are closed by lids 2,2 in combination with terminals 5, 5.

Furthermore, as discussed above, applicants discovered that including an aluminum-aluminum contact between a cathode current collector and a positive lead provides a more robust connection than an aluminum-stainless steel contact; and that such an aluminum-aluminum contact can result in a battery having an impedance that increases by less than 0.20 Ohms after the battery is dropped six times from a height of one meter onto a hard surface. Nakanishi does not disclose or suggest such batteries. Instead, Nakanishi discloses batteries having electrode terminals that could be tightened with sufficient torque to decrease leakage. (See, e.g., Nakanishi, col. 2, lines 38-41, and col. 6, line 37- col. 7, line 33).

A person having ordinary skill in the art would also not have been motivated to modify Nakanishi's battery to arrive at the batteries covered by the claims, as Nakanishi's battery construction works well for its intended purpose. Nakanishi's battery has a much different structure. Moreover, Nakanishi discloses that negative electrode 81, and positive electrode terminal 51 which has improved strength and can be tightened up with sufficiently great torque, decrease the incidence of leakage and retain a satisfactory sealing effect. (See, e.g., id).

Therefore, Nakanishi does not disclose or suggest the subject matter covered claims 1-27 and 30-36, and there is no motivation to modify Nakanishi's battery to arrive at the subject matter of the claims. Thus, Applicants respectfully request that the rejections of claims 1-27 and 30-36 under 35 U.S.C. §102(e) or 35 U.S.C. § 103 (a) be reconsidered and withdrawn.

Furthermore, claims 18-20 cover batteries having positive leads including one or more extensions, and are patentable over Nakanishi, at least because Nakanishi does not disclose or suggest such batteries. Applicants request that the rejection of claims 18-20 be withdrawn for this additional reason.

In addition, applicants note that Tischer and Shembel do not cure the deficiencies of Nakanishi. Tischer does not disclose or suggest a housing having a continuous external wall defining an opening at a first end of the battery and enclosing the second end, or closing this opening by a positive external contact in contact with a positive lead. Instead, Tischer discloses an aluminum-silicon carbide composite for use in high temperature sodium-sulfur batteries. (See, e.g., Tischer, page 377, Introduction). Shembel also does not disclose or suggest a housing having a continuous external wall defining an opening at the first end of the battery, or closing this opening by a positive external contact in contact with a positive lead.

Applicants submit that the claims are in condition for allowance and such action is respectfully requested.

Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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INTERNATIONAL STANDARD

IEC 60086-4

Second edition
2000-03

Primary batteries –

July 8 2002

Part 4:
Safety of lithium batteries

Piles électriques –

Partie 4:
Sécurité des piles au lithium

IEC

Reference number
IEC 60086-4:2000(E)

6.3.2.7 Electrical test D-7 – Overdischarge 3

a) Purpose

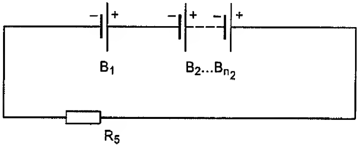
This test simulates the condition when a battery with abnormally high internal resistance is connected in series with normal batteries.

b) Test procedure

The test battery shall be predischarged to 25 % depth of discharge. It shall then be stored at (60 ± 2) °C for 10 days to increase the internal resistance. Additional batteries shall be predischarged to the same depth of discharge. They shall be stored at ambient temperature for 10 days. The preconditioned test battery shall be connected in series with (n_2 – 1) preconditioned additional batteries and a resistive load R_5 where n_2 and R_5 are taken from table 5.

The test shall be carried out at (20 ± 2) °C for 24 h.

The test shall be repeated twice, namely with test and additional batteries predischarged to 50 % and 75 % depth of discharge.



Key

B_1	Test battery, 25 % predischarged and preconditioned at (60 ± 2) °C for 10 days and, in separate tests, 50 % and 75 % predischarged
$B_2 \ldots B_{n_2}$	Additional batteries, 25 % predischarged and stored at (20 ± 2) °C for 10 days and, in separate tests, 50 % and 75 % predischarged
R_5	Resistive load

Figure 8 – Overdischarge 3

c) Requirements

See table 4.

6.3.2.8 Mechanical test E-1 – Free fall

a) Purpose

This test simulates the situation when a battery is accidentally dropped. The test condition is based upon IEC 60068-2-32 [6].

b) Test procedure

Undischarged test batteries shall be dropped from a height of 1 m onto a concrete surface. Each test battery shall be dropped six times, a prismatic battery once on each of its six faces, a round battery twice in each of the three axes shown in figure 9. The test batteries shall be stored for 1 h afterwards.